

What Is Claimed Is:

1 1. A back-up heating system for a building having a first, enclosed
2 compartment containing tooling for semiconductor fabrication, and a second,
3 enclosed compartment containing electrically powered air handling equipment for
4 constant exhaust of air from and intake of air into said first compartment, and a first,
5 hot water heat exchanger having a first flow path, through which water heated by a
6 boiler remote from said building is circulated, and a second flow path, through which
7 building level heating water is circulated to absorb heat from said boiler-heated water
8 prior to transfer, through at least one hot water radiation heater, of some of said heat
9 to the air in said building, said back-up heating system comprising:

10 a) a liquid cooled, internal combustion engine and generator for generating
11 electricity during periods of primary power outage to operate said air handling
12 equipment;

13 b) a heat rejecting radiator for selective connection to receive liquid coolant
14 from said engine, reject heat from said coolant and return said coolant to said engine
15 when outside temperature is above said predetermined value;

16 c) a second heat exchanger positioned within said building and having a third
17 flow path, for selective connection, alternatively to said radiator, for circulation of
18 liquid coolant from said engine, and a fourth flow path, for selective connection to
19 receive said heating water from said heater prior to circulation of said heating water
20 through said second flow path;

21 d) first means selectively operable to control flow of said coolant between said
22 radiator and said third flow path; and

23 e) second means selectively operable to control flow of said heating water
24 between a direct connection from said heater to said second flow path and connection
25 to said fourth flow path and thence to said second flow path.

1 2. The back-up heating system of claim 1 wherein said first means comprises
2 a first valve.

1 3. The back-up heating system of claim 2 where said first valve is a three-way
2 valve selectively actuatable to direct said coolant alternatively between said radiator
3 and said third flow path.

1 4. The back-up heating system of claim 3 wherein said second means
2 comprises a second valve.

1 5. The back-up heating system of claim 4 wherein said second valve is a
2 three-way valve selectively actuatable to direct said heating water from said heater
3 alternatively between said second flow path and said fourth flow path.

1 6. The back-up heating system of claim 1 and further including a booster
2 pump positioned said fourth flow path and said second flow path to augment flow of
3 said heating water from said fourth flow path to said second flow path when said
4 second means is selectively operated to direct flow of said heating water from said
5 heater to said fourth flow path and thence to said second flow path

1 7. The back-up heating system of claim 1 wherein said radiator is located
2 outside said building to reject heat to outside air.

1 8. The back-up heating system of claim 1 wherein said air handling
2 equipment and said at least one heater are located in said second building
3 compartment.

1 9. In a manufacturing facility having a first building housing at least one fluid
2 fired boiler and electrically operated pump for supplying boiler-heated water to a first
3 flow path of a first heat exchanger in at least one other building when outside
4 temperature is below a first predetermined value, and a first internal combustion
5 engine powering an electrical generator to supply power for operating said pump
6 during periods of primary power outage, said other building housing at least one hot
7 water radiation heater with building level heating water circulated through the second
8 flow path of said first heat exchanger to absorb heat from said boiler-heated water and
9 through said heater, fabrication tooling which is susceptible to damage by exposure to
10 temperature below a second, predetermined value and/or temperature drop in excess
11 of a predetermined rate, electrically operated air handling equipment providing a
12 constant exhaust of air from and intake of outside air into said other building, and a
13 second, liquid cooled, internal combustion engine powering an electrical generator to
14 provide electrical power to said air handling equipment during periods of primary
15 power outage,
16 a system for preventing temperature drop below said second, predetermined
17 value and/or temperature drop in excess of said predetermined rate within said second
18 building during periods of primary power outage when outside temperature is below
19 said first predetermined value, said system comprising;
20 a) a second heat exchanger having a third flow path with a first inlet and a first
21 outlet, and a fourth flow path with a second inlet and a second outlet;
22 b) first means for selectively directing liquid coolant from said second engine
23 through said third flow path and back to said engine; and

24 c) second means for selectively directing said heating water from said said
25 heater to said fourth flow path prior to circulation through said second flow path and
26 thence back to said heater.

1 10. The system of claim 9 and further including a heat rejecting radiator
2 positioned outside said second building and to which the second engine coolant line
3 may be connected, and wherein said first means comprises a first valve selectively
4 operable to direct coolant alternatively between said radiator and said third flow path
5 of said second heat exchanger.

1 11. The system of claim 10 wherein said second means comprise a second
2 valve selectively operable to direct said heating water from said heater alternately
3 between a direct connection to said second flow path of said first heat exchanger and
4 connection to said fourth flow path of said second heat exchanger and thence to said
5 second flow path of said first heat exchanger.

1 12. The system of claim 11 wherein said first and second valves are three-way
2 valves.

1 13. The system of claim 9 wherein said other building is divided into first and
2 second, enclosed compartments, said first compartment being positioned vertically
3 above said second compartment, said first compartment housing said air handling
4 equipment, said heater and said second engine and generator, and said second
5 compartment housing said fabrication tooling.

1 14. The system of claim 9 wherein said fabrication tooling comprises
2 photolithography equipment used in the fabrication of semiconductor components.

1 15. The system of claim 9 wherein said first and second means each include a
2 three-way valve, and said second means further comprises a booster pump.

1 16. The method of protecting temperature-sensitive production tooling from
2 potentially damaging low temperatures and rapid temperature drops, said method
3 being employed in a manufacturing facility having:
4 a central utility plant housing at least one fluid-fired boiler with an electrically
5 powered first pump for circulating water from said boiler to a first flow path of at
6 least one, first heat exchanger when outside temperature is below a predetermined
7 value, and a first internal combustion engine and generator for providing electrical
8 power to said first pump when the latter is in use during periods of primary power
9 outage, and
10 one or more fabrication buildings each housing at least one of said first heat
11 exchangers, a hot water radiation heater for flow of heating water through a second
12 flow path of said first heat exchanger,, electrically powered air handling equipment
13 for exhausting air at a predetermined rate from and drawing outside air at
14 substantially said predetermined rate into the associated one of said fabrication
15 buildings, a second, liquid cooled, internal combustion and generator for providing
16 electrical power to said air handling equipment during periods of primary power
17 outage, and a heat rejecting radiator connected to receive hot coolant from and return
18 cooled coolant to said second engine during periods of primary power outage when
19 outside temperature is above said predetermined level,
20 said method comprising:
21 a) providing a second heat exchanger having third and fourth flow paths in
22 each of said fabrication buildings;

23 b) providing a first valve selectively operable to block flow of said coolant
24 from said second engine to said radiator and directing said coolant through a first,
25 alternate flow line to said third flow path;
26 c) providing a second valve selectively operable to block flow of said heating
27 water to said second flow path and directing said heating water through a second,
28 alternative flow line to said fourth flow path, whereby said heating water absorbs heat
29 from said coolant in said second heat exchanger;
30 d) providing a third flow line connected to direct said heating water from said
31 fourth flow path to said second flow path, whereby said heating water absorbs heat
32 from said boiler heated water;
33 e) observing the temperature outside said fabrication buildings during periods
34 of primary power outage; and
35 f) actuating both of said first and second valves when the observed
36 temperature is below said predetermined value.

1 17. The method of claim 16 wherein said first and second valves are three-
2 way valves.

1 18. The method of claim 16 and comprising the further steps of positioning a
2 selectively operable booster pump in said third line and operating said booster pump
3 only when said first and second valves are actuated.

1 19. The method of claim 16 wherein each of said fabrication buildings is
2 divided into upper and lower, substantially exclusive compartments, and air is drawn
3 by said air handling equipment into, and heated by said heater in said upper
4 compartment for delivery to said lower compartment, said second engine and
5 generator and said second heat exchanger are positioned in said upper compartment,
6 said production tooling is positioned in said lower compartment, and said radiator is
7 positioned outside said other building.